December 2001

VANALCO Aluminum
(former ALCOA Aluminum Plant)
Sediment Quality Evaluation

ABSTRACT

This evaluation was conducted following procedures set forth in the Inland Testing Manual, developed jointly by the U.S. Army Corps of Engineers and the U.S. Environmental Protection Agency to assess dredged material. Guidelines used are those developed to implement the Clean Water Act. These guidelines and associated screening levels are those adopted for use in the Dredge Material Evaluation Framework for the Lower Columbia River Management Area, November 1998.

A total of twenty-five (25) samples were collected from the north side of the Federal navigation channel and the adjacent nearer shore area for PCB contamination at the former ALCOA aluminum plant (VANALCO), Columbia River mile 103. This sampling was conducted to confirm PCB contamination and further characterize the Federal channel and adjacent sediments for possible contaminants. Dredging in this portion of the Federal channel is not scheduled or anticipated at the present time.

One (1) vibra-core sample was analyzed in two (2) four (4) foot lifts. The two (2) lifts were submitted for physical analyses including total volatile solids and were analyzed for metals (9 inorganic), total organic carbon, pesticides and polychlorinated biphenyls (PCBs), phenols, phthalates, miscellaneous extractables, polynuclear aromatic hydrocarbons, organotin, and dioxin/furan. An additional twenty-four (24) surface grab samples were analyzed only for pesticides and PCBs.

None of the contaminants tested were found to be at or above their respective SLs in the two (2) vibra-core samples. In the six (6) grab samples taken nearest to the shore, V-PG-02 to V-PG-07, Aroclor 1248 (a PCB) was found at levels that exceeded the SL of 130 ug/kg for total PCBs. The sediment represented by these samples would need to be further characterized under Tier III testing to determine its suitability for disposal if dredging would be needed in this area. For grab samples V-PG-08 to V-PG-25, the values for total DDT and PCBs were found to be significantly below the SLs for these contaminants.

INTRODUCTION

This report characterizes the sediment on the north side of the Federal navigation channel and the adjacent nearer shore area for PCB contamination at the former ALCOA aluminum plant (VANALCO), Columbia River mile 103. The goal of this sampling event is to confirm PCB contamination and further characterize the Federal channel and adjacent sediments for possible contaminants. Dredging in this portion of the Federal channel is not scheduled or anticipated at the present time. The sampling and analysis objectives are

stated in the Sampling and Analysis Plan (SAP June 2001), and are also listed below. This report will outline the procedures used to accomplish these objectives.

Sampling and Analysis Objectives

- Characterize sediments in accordance with the regional dredge material testing manual, the Dredge Material Evaluation Framework for the Lower Columbia River Management Area (DMEF).

- Physical and chemical analyses will be conducted on one (1) vibra-core sample at the site of the highest concentration of the reported PCB contamination. The vibra-core sample will be analyzed for up to three (3) lifts, depending upon core recovery length. An additional twenty-five (25) surface grab samples will be analyzed for PCBs only. The twenty-five (25) surface samples will be in a grid 150 to 200 feet apart over the contaminated area.

- Collect, handle and analyze representative sediment of the purposed dredging prism, in accordance with protocols and Quality Assurance/Quality Control (QA/QC) requirements.

- Characterize sediments to be dredged for evaluation of environmental impact.

- Conduct physical and chemical characterization only for this sediment evaluation.

PREVIOUS STUDIES

No previous sediment evaluations have been performed in this area by the U.S. Army Corps of Engineers, Portland District. However, PCB contamination in the area has been reported to the Washington Department of Ecology. In a report prepared for Alcoa, Inc., dated March 2000, Wind Ward Environmental LLC of Seattle, Washington, discussed the results of a December 1999 sampling event where 35 surface grab samples were collected and analyzed for PCBs. Of the 35 samples collected, 26 analyses found PCBs to be present above the method detection limit (MDL); 15 analyses exceeded the 130 ug/kg screening level (SL) in the DMEF, ranging from 150 ug/kg to 28,000 ug/kg.

CURRENT SAMPLING EVENT/DISCUSSION

A total of twenty-five (25) samples were collected from the north side of the Federal navigation channel and the adjacent nearer shore area at Columbia River mile 103. Physical and chemical analyses were conducted on one (1) vibra-core sample, which was taken at the site of the highest concentration of the reported PCB contamination (see Table 1 and Figure 1). The vibra-core sample was analyzed in two (2) four (4) foot lifts, with the lift closest to the surface designated as “A” and the next lift down designated as “B.”

The two (2) lifts were submitted for physical analyses including total volatile solids (TVS) and were analyzed for metals (9 inorganic), total organic carbon (TOC), pesticides and polychlorinated biphenyls (PCBs), phenols, phthalates, miscellaneous extractables, polynuclear aromatic hydrocarbons (PAHs), organotin (TBT), and dioxin/furan. An additional twenty-four (24) surface grab samples were analyzed only for pesticides and PCBs. These surface samples were in a grid 150 to 200 feet apart over the contaminated area (see Figure 1).

Table 1. Sample Location Coordinates
(NAD 83, Oregon State Plane North)

Sample Number	Latitude	Longitude
V-VC-01A	45º 38' 38.36"	122º 43' 45.92"
V-VC-01B	45º 38' 38.36"	122º 43' 45.92"
V-VC-02	45º 38' 41.61"	122º 43' 54.44"
V-VC-03	45º 38' 40.92"	122º 43' 51.6"
V-VC-04	45º 38' 40.62"	122º 43' 49.1"
V-VC-05	45º 38' 40.19"	122º 43' 46.54"
V-VC-06	45º 38' 39.45"	122º 43' 43.58"
V-VC-07	45º 38' 38.7"	122º 43' 41.18"
V-VC-08	45º 38' 40.88"	122º 43' 58.14"
V-VC-09	45º 38' 40.21"	122º 43' 55.24"
V-VC-10	45º 38' 38.47"	122º 43' 52.7"
V-VC-11	45º 38' 39.13"	122º 43' 49.81"
V-VC-12	45º 38' 38.37"	122º 43' 47.28"
V-VC-13	45º 38' 33.97"	122º 43' 44.68"
V-VC-14	45º 38' 37.27"	122º 43' 42.24"
V-VC-15	45º 38' 39.52"	122º 43' 58.77"
V-VC-16	45º 38' 38.76"	122º 43' 55.84"
V-VC-17	45º 38' 38.07"	122º 43' 53.78"
V-VC-18	45º 38' 37.6"	122º 43' 50.91"
V-VC-19	45º 38' 36.92"	122º 43' 48.46"
V-VC-20	45º 38' 36.62"	122º 43' 45.46"
V-VC-21	45º 38' 35.81"	122º 43' 42.98"
V-VC-22	45º 38' 38.43"	122º 43' 59.15"
V-VC-23	45º 38' 37.68"	122º 43' 56.65"
V-VC-24	45º 38' 37.32"	122º 43' 54.13"
V-VC-25	45º 38' 36.57"	122º 43' 51.65"

RESULTS

The results discussed below reflect analyses of one (1) vibra core sample divided into two (2) four (4) foot lifts, with 24 surface grab samples submitted for only pesticide and PCB analyses.

Physical and Volatile Solids (ASTM methods). Two (2) vibra-core samples were submitted for physical and TVS analyses and the data are presented in Table 1. Neither sample exceeded 20% fines and/or 5% volatile solids. The samples were classified as "poorly graded sand." Mean grain size for the samples is 0.41 mm, with 0.94% gravel, 99.22% sand and 0.22% fines. Volatile solids for the samples were 0.72% and 0.71%.

Metals (EPA method 6020/7471), Total Organic Carbon (EPA method 9060). Two (2) vibra-core samples were submitted for testing and the data are presented in Table 2. Although low levels of most metals were found in the samples, all values were well below their respective SLs. The TOC was 660 and 370 mg/kg in the samples.

Organotin [total (bulk) TBT]. Two (2) vibra-core samples were tested and the data are presented in Table 3. The lab was not able to extract the amount of pore water necessary to run the pore water method analysis, so total (bulk) TBT was analyzed. Tributyltin was detected in one sample (V-VC-01A) at 5.8 ug/kg, which is below the screening level of 73 ug/kg TBT (PSDDA 1996). Monobutyltin, which is a breakdown product of tributyltin, was detected in one sample (V-VC-01B) at 1.5 ug/kg (estimated value), which also is below the screening level of 73 ug/kg TBT (PSDDA 1996).

Pesticides and PCBs (EPA method 8081A/8082). Two (2) vibra-core samples and twenty-four (24) grab samples were tested for pesticides and PCBs and the data are presented in Table 4. Pesticides were detected in some of the grab samples. 4,4'-DDE was detected in two (2) samples (V-PG-07 at 1.1 ug/kg and V-PG-11 at 0.73 ug/kg) and the laboratory flagged these values as being estimated concentrations. Both values, however, were well below the SL of 6.9 ug/kg for total DDT. Total DDT and its breakdown products, DDD and DDE, were not detected above the MDL in the vibra-core samples or in the remaining grab samples.

The pesticides endosulfan sulfate and methoxychlor were detected in grab sample V-PG-05 at estimated concentrations of 2.3 ug/kg and 5.5 ug/kg, respectively. Endrin ketone was detected in grab sample V-PG-04 at an estimated concentration of 4.7 ug/kg. While no SL has been established for these pesticides, these estimated values are considered low.

Aroclor 1248 (a PCB) was detected in six (6) of the grab samples taken nearest to the shore (V-PG-02 through V-PG-07), and most levels were found to exceed the SL of 130 ug/kg for total PCBs. For grab samples V-PG-08 to V-PG-25, the values for PCBs were not detected above the MDL.

Phenols, Phthalates and Miscellaneous Extractables (EPA method 8270). Two (2) vibra-core samples were tested and the data are presented in Table 5. Two phthalate compounds were detected in the samples, but the values were well below their respective SLs. No phenols or miscellaneous extractables were found at the MDL in either sample.

Polynuclear Aromatic Hydrocarbons (EPA method 8270C). Two (2) vibra-core samples were tested and the data are presented in Tables 6 and 7. The "low molecular weight" PAHs were not detected at the MDL in either sample, except for phenanthrene in sample

V-VC-01A at a value below 1% of the SL. Low levels of all "high molecular weight" PAHs were found in sample V-VC-01A but all values ranged below 1% of their respective SLs. The "high molecular weight" PAHs were not detected at the MDL in sample V-VC-01B, except for benzo(b)fluroanthene, which was at a negligible level.

Dioxins/Furans (Method SW846 8290). Two (2) vibra-core samples were tested and the data are presented in Tables 8 and 9. Dioxin (2,3,7,8-TCDD) and furan (2,3,7,8-TCDF) were not found at the MDL in the samples. The total toxic equivalent concentration value for the samples was well below the guidance concentration value.

CONCLUSION

Collection and evaluation of the sediment data was completed using guidelines from the Dredge Material Evaluation Framework for the Lower Columbia River Management Area (DMEF). The DMEF is a regional manual developed jointly with regional EPA, Corps, Oregon Department of Environmental Quality and Washington Departments of Ecology and Natural Resources. This document is a guideline for implementing the Clean Water Act (40 CFR 230) and Section 404 (b)(1). The screening levels used are those adopted for use in the DMEF, final November 1998. The DMEF tiered testing approach requires that material in excess of 20% fines and greater than 5% volatile solids, as well as any material with prior history or is suspected ("reason to believe") of being contaminated, be subjected to chemical as well as physical analyses.

A total of twenty-five (25) samples were collected from the north side of the Federal navigation channel and the adjacent nearer shore area for PCB contamination at the former ALCOA aluminum plant (VANALCO), Columbia River mile 103. This sampling was conducted to confirm PCB contamination and further characterize the Federal channel and adjacent sediments for possible contaminants. Dredging in this portion of the Federal channel is not scheduled or anticipated at the present time.

One (1) vibra-core sample was analyzed in two 4-foot lifts. The two (2) lifts were submitted for physical analyses including total volatile solids and were analyzed for metals (9 inorganic), total organic carbon, pesticides and polychlorinated biphenyls (PCBs), phenols, phthalates, miscellaneous extractables, polynuclear aromatic hydrocarbons, organotin, and dioxin/furan. An additional twenty-four (24) surface grab samples were analyzed only for pesticides and PCBs. The station location of the vibra-core sample V-VC-01 was selected to duplicate the location of the highest analytical result (28,000 ug/kg) reported for PCBs in a sample from the Wind Ward Environmental report (2000).

None of the contaminants tested were found to be at or above their respective SLs in the two (2) vibra-core samples. In the six (6) grab samples taken nearest to the shore, V-PG-02 to V-PG-07, Aroclor 1248 (a PCB) was found at levels that exceeded the SL of 130 ug/kg for total PCBs. The sediment represented by these samples would need to be further characterized under Tier III testing to determine its suitability for disposal if dredging would be needed in this area. All samples showing contamination above screening levels are well outside the federal channel. The contamination is far enough removed from the

channel to effect any channel maintenance through this area, if required. For grab samples V-PG-08 to V-PG-25, the values for total DDT and PCBs were found to be significantly below the SLs for these contaminants. No further characterization would be required for material represented by samples 08 - 25 to be dredged and placed in an unconfined disposal site.

REFERENCES

1. U.S. Army Corps of Engineers, Portland District and Seattle District; U.S. Environmental Protection Agency, Region 10; Oregon Department of Environmental Quality; Washington State Department of Natural Resources and Department of Ecology. 1998 Final. Dredge Material Evaluation Framework for the Lower Columbia River Management Area.

2. U.S. Environmental Protection Agency and U.S. Army Corps of Engineers. February 1998. Evaluation of Dredged Material Proposed for Discharge in Inland and Near Coastal Waters - Testing Manual (referred to as the "Inland Testing Manual").

3. Clean Water Act, 40 CFR 230 (b)(1).

4. U.S. Army Corps of Engineers. June 2001. Sediment Sampling and Analysis Plan for VANALCO Aluminum (Former ALCOA Aluminum Plant) and Columbia River Channel Deepening (CRCD) Station #76 (CR-BC-76). Portland District.

5. PSDDA. 1996. Puget Sound Dredged Disposal Analysis, Technical Information Memorandum, Testing, Reporting and Evaluation of Tributyltin Data in PSDDA and SMS Programs.

6. Wind Ward Environmental. March 2000. Alcoa Former Vancouver Works Sediment Investigation Data Report. Wind Ward Environmental LLC, 200 West Mercer Street, Suite 401, Seattle, Washington.

Table 1. VANALCO **Sampled June 20-21, 2001**

Physical Analysis & Volatile Solids

Sample I.D.	Grain Size (mm)		Percent			
	Median	Mean	Gravel	Sand	Silt/Clay	Volatile Solids
V-VC-01A	0.37	0.301	0.00	99.93	0.07	0.72
V-VC-01B	0.44	0.455	1.88	98.50	0.37	0.71
Mean	0.41	0.378	0.94	99.22	0.22	0.72

Table 2. VANALCO **Sampled June 20-21, 2001**

Inorganic Metals and TOC

Sample I.D.	As	Sb	Cd	Cu	Pb	Hg	Ni	Ag	Zn	TOC
	mg/kg (ppm)									
V-VC-01A	0.98 J	<0.023	0.25 J	5.6	3.1	<0.03	6.4	<0.055	36	660
V-VC-01B	0.86 J	0.76 J	0.28 J	5.4	2.2	<0.028	6.1	<0.052	29	370
Screening level (SL)	57	150	5.1	390	450	0.41	140	6.1	410	

J = Estimated value (reported values are above the MDL, but below the PQL).
Symbol (<) = Non-detect (ND) at the value listed (Method Detection Limit).

Table 3. VANALCO **Sampled June 20-21, 2001**

Organotin

Total (Bulk) TBT

Sample I.D.	Tetrabutyltin	Tributyltin	Dibutyltin	Monobutyltin	Total TBT
	ug/kg				
V-VC-01A	<0.57	5.8	<0.74	<1.6	5.8
V-VC-01B	<0.51	<1.1	<0.66	1.5 J	1.5 J
Screening level (SL)					73*

*SL Reference: Puget Sound Dredged Disposal Analysis (PSDDA), Technical Information Memorandum, Testing, Reporting and Evaluation of Tributyltin Data in PSDDA and SMS Programs, 1996.

J = Estimated value (reported values are above the MDL, but below the PQL).

Symbol (<) = Non-detect (ND) at the value listed (Method Detection Limit).

Table 4. VANALCO **Sampled June 20-21, 2001**

Pesticides and PCBs

Sample I.D.	Pesticides							PCBs
	ug/kg							
	4,4'-DDD	4,4'-DDE	4,4'-DDT	Total DDT	Endosulfan sulfate	Methoxy-chlor	Endrin ketone	Aroclor 1248
V-VC-01A	<0.21	<0.25	<0.29	ND	<0.4	<1.5	<0.31	<2.2
V-VC-01B	<0.21	<0.25	<0.29	ND	<0.4	<1.5	<0.31	<2.2
V-PG-02	<0.24	<0.28	<0.32	ND	<0.44	<1.7	<0.34	220 C1
V-PG-03	<0.25	<0.29	<0.33	ND	<0.46	<1.7	<0.36	270 C1
V-PG-04	<3	<3	<3	ND	<3	<15	4.7 C1	120 C1
V-PG-05	<0.26	<0.31	<0.35	ND	2.3 J C2	5.5 J C2	<0.38	260 C1
V-PG-06	<0.28	<0.33	<0.38	ND	<0.53	<2	<0.41	1400 C1*
V-PG-07	<0.28	1.1 J C1	<0.38	1.1 J C1	<0.53	<2	<0.41	97 C1
V-PG-08	<0.25	<0.29	<0.33	ND	<0.47	<1.8	<0.36	<2.6
V-PG-09	<0.27	<0.32	<0.36	ND	<0.51	<1.9	<0.4	<2.8
V-PG-10	<0.26	<0.3	<0.34	ND	<0.48	<1.8	<0.37	<2.6
V-PG-11	<0.29	0.73 J C2	<0.38	0.73 J C2	<0.54	<2	<0.41	<3
V-PG-12	<0.28	<0.33	<0.37	ND	<0.52	<2	<0.4	<2.9
V-PG-13	<0.26	<0.31	<0.35	ND	<0.49	<1.9	<0.38	<2.7
V-PG-14	<0.27	<0.32	<0.36	ND	<0.5	<1.9	<0.39	<2.8
V-PG-15	<0.27	<0.31	<0.35	ND	<0.5	<1.9	<0.38	<2.7
V-PG-16	<0.27	<0.32	<0.36	ND	<0.5	<1.9	<0.39	<2.8
V-PG-17	<0.26	<0.3	<0.34	ND	<0.48	<1.8	<0.37	<2.6
V-PG-18	<0.27	<0.32	<0.36	ND	<0.5	<1.9	<0.39	<2.8
V-PG-19	<0.23	<0.28	<0.31	ND	<0.44	<1.6	<0.34	<2.4
V-PG-20	<0.23	<0.28	<0.31	ND	<0.44	<1.7	<0.34	<2.4
V-PG-21	<0.24	<0.28	<0.32	ND	<0.45	<1.7	<0.35	<2.5
V-PG-22	<0.27	<0.32	<0.36	ND	<0.51	<1.9	<0.39	<2.8
V-PG-23	<0.26	<0.31	<0.35	ND	<0.49	<1.8	<0.37	<2.7
V-PG-24	<0.23	<0.28	<0.31	ND	<0.44	<1.7	<0.34	<2.4
V-PG-25	<0.27	<0.32	<0.36	ND	<0.5	<1.9	<0.39	<2.8
Screen level (SL)	DDD + DDE + DDT = 6.9				**	**	**	130 Total PCBs

* Value reported based on secondary dilution.
** SL not established.
J = Estimated value (reported values are above the MDL, but below the PQL).
C1 = Second column confirmation performed. The relative percent difference value (RPD) between the results on the two columns was evaluated and determined to be ≤40%.
C2 = Second column confirmation performed. The RPD between the results on the two columns was evaluated and determined to be >40%. The higher result was reported unless anomalies were noted.
Symbol (<) = Non-detect (ND) at the value listed (Method Detection Limit).

Table 5. VANALCO **Sampled June 20-21, 2001**

Phenols*, Phthalates and Extractables*

Sample I.D.	Phthalates	
	ug/kg (ppb)	
	bis(2-Ethylhexyl)-phthalate	Butylbenzyl-phthalate
V-VC-01A	6.3 J B1	<2.7
V-VC-01B	7.1 J B1	3.2 J
Screening level (SL)	8300	970

***No Phenols or Extractables** were found in the samples at their MDLs.

J = Estimated value (reported values are above the MDL, but below the PQL).

B1 = Low-level contamination was present in the method blank (reported level was <10 times blank concentration).

Symbol (<) = Non-detect (ND) at the value listed (Method Detection Limit).

Table 6. VANALCO **Sampled June 20-21, 2001**

Polynuclear Aromatic Hydrocarbons (PAHs)

Low Molecular Weight Analytes

ug/kg (ppb)

Sample I.D.	Acenaphthene	Acenaphthylene	Anthracene	Fluorene	2-Methyl naphthalene	Naphthalene	Phen-anthrene	Total Low PAHs
V-VC-01A	<0.69	<0.61	<0.35	<0.65	<0.22	<0.65	10	10
V-VC-01B	<0.68	<0.6	<0.35	<0.64	<0.21	<0.64	<0.29	ND
Screen level (SL)	500	560	960	540	670	2100	1500	5200
Symbol (<) = Non-detect (ND) at the value listed (Method Detection Limit)								

Table 7. VANALCO **Sampled June 20-21, 2001**

Polynuclear Aromatic Hydrocarbons (PAHs)

High Molecular Weight Analytes

ug/kg (ppb)

Sample I.D.	Benzo(b)-fluro-anthene	Benzo(k)-fluro-anthene	Benzo-(g,h,i)-perylene	Chrysene	Pyrene	Benzo(a)-pyrene	Benzo(a)-anthracene	Indeno-(1,2,3-cd)-pyrene	Fluor-anthene	Total High PAHs
V-VC-01A	6.7	2.5	1.7	5.3	11	4.7	3.5	2.1	12	49.5
V-VC-01B	1.6	<0.6	<0.23	<0.81	<0.45	<0.81	<0.84	<0.32	<0.64	1.6
Screen level (SL)	b + k = 3200		670	1400	2600	1600	1300	600	1700	12000

Symbol (<) = Non-detect (ND) at the value listed (Method Detection Limit)

Table 8. VANALCO **Sampled June 20-21, 2001**

Dioxins/Furans (ng/kg, pptr)

Sample I.D.	Dioxin/Furan	Result	½ MDL	TEF	TEQ	Guidance*
V-VC-01A - Dioxin	2,3,7,8-TCDD	<0.47	0.235	1.0	0.235	A bulk sediment 2,3,7,8-tetrachlorodibenzo-p-dioxin concentration of 5 ng/kg, or a total toxic equivalent concentration of 15 ng/kg will trigger the requirement to perform bioaccumulation testing.
	Total TCDD	<0.47	0.235	0	0	
	1,2,3,7,8-PeCDD	<0.81	0.405	0.5	0.203	
	Total PeCDD	<1.1	0.55	0	0	
	1,2,3,4,7,8-HxCDD	0.61		0.1	0.061	
	1,2,3,6,7,8-HxCDD	<0.65	0.235	0.1	0.033	
	1,2,3,7,8,9-HxCDD	<0.59	0.295	0.1	0.029	
	Total HxCDD	<1.8	0.9	0	0	
	1,2,3,4,6,7,8-HpCDD	4.2 J		0.01	0.042	
	Total HpCDD	9.5		0	0	
	OCDD	33		0.001	0.033	
V-VC-01A - Furan	2,3,7,8-TCDF	<0.47	0.235	0.1	0.024	
	Total TCDF	<0.47	0.235	0	0	
	1,2,3,7,8-PeCDF	<0.43	0.215	0.05	0.011	
	2,3,4,7,8-PeCDF	<0.42	0.21	0.05	0.011	
	Total PeDCF	<0.48	0.24	0	0	
	1,2,3,4,7,8-HxCDF	<0.67	0.335	0.1	0.034	
	1,2,3,6,7,8-HxCDF	<0.64	0.32	0.1	0.032	
	2,3,4,6,7,8-HxCDF	<0.71	0.355	0.1	0.036	
	1,2,3,7,8,9-HxCDF	<0.79	0.395	0.1	0.039	
	Total HxCDF	<0.79	0.395	0	0	
	1,2,3,4,6,7,8-HpCDF	<0.80	0.40	0.01	0.004	
	1,2,3,4,7,8,9-HpCDF	<0.50	0.25	0.01	0.003	
	Total HpCDF	<1.2	0.6	0	0	
	OCDF	<1.1	0.55	0.001	0.001	
Total Dioxins/Furans TEQ					**0.831**	**<15 ng/kg**

J = Estimated result. Result is < reporting limit.
MDL = Method Detection Limit
TEQ = Toxicity Equivalency Quotient
TEF = Toxicity Equivalency Factors
*Guidance = Puget Sound Dredged Disposal Analysis (PSDDA) Program (Feb 2000) and U.S. EPA Toxicity Equivalency Factors (U.S. EPA 1989; Ahlborg et al. 1994)

Table 9. VANALCO **Sampled June 20-21, 2001**

Dioxins/Furans (ng/kg, pptr)

Sample I.D.	Dioxin/Furan	Result	½ MDL	TEF	TEQ	Guidance*
V-VC-01B - Dioxin	2,3,7,8-TCDD	<0.36	0.18	1.0	0.18	A bulk sediment 2,3,7,8-tetrachlorodibenzo-p-dioxin concentration of 5 ng/kg, or a total toxic equivalent concentration of 15 ng/kg will trigger the requirement to perform bioaccumulation testing.
	Total TCDD	<0.36	0.18	0	0	
	1,2,3,7,8-PeCDD	<0.59	0.295	0.5	0.148	
	Total PeCDD	<0.77	0.385	0	0	
	1,2,3,4,7,8-HxCDD	<0.54	0.27	0.1	0.027	
	1,2,3,6,7,8-HxCDD	<0.57	0.143	0.1	0.014	
	1,2,3,7,8,9-HxCDD	<0.52	0.26	0.1	0.026	
	Total HxCDD	<0.57	0.143	0	0	
	1,2,3,4,6,7,8-HpCDD	<1.0	0.5	0.01	0.005	
	Total HpCDD	<1.0	0.5	0	0	
	OCDD	7.1 J		0.001	0.007	
V-VC-01B - Furan	2,3,7,8-TCDF	<0.35	0.175	0.1	0.018	
	Total TCDF	<0.35	0.175	0	0	
	1,2,3,7,8-PeCDF	<0.38	0.19	0.05	0.009	
	2,3,4,7,8-PeCDF	<0.36	0.18	0.05	0.009	
	Total PeDCF	<0.45	0.225	0	0	
	1,2,3,4,7,8-HxCDF	<0.54	0.27	0.1	0.027	
	1,2,3,6,7,8-HxCDF	<0.52	0.26	0.1	0.026	
	2,3,4,6,7,8-HxCDF	<0.57	0.143	0.1	0.014	
	1,2,3,7,8,9-HxCDF	<0.65	0.325	0.1	0.033	
	Total HxCDF	<0.65	0.325	0	0	
	1,2,3,4,6,7,8-HpCDF	<0.27	0.135	0.01	0.001	
	1,2,3,4,7,8,9-HpCDF	<0.32	0.16	0.01	0.002	
	Total HpCDF	<0.35	0.175	0	0	
	OCDF	<0.74	0.37	0.001	0.001	
Total Dioxins/Furans TEQ					**0.547**	**<15 ng/kg**

J = Estimated result. Result is < reporting limit.
MDL = Method Detection Limit
TEQ = Toxicity Equivalency Quotient
TEF = Toxicity Equivalency Factors
*Guidance = Puget Sound Dredged Disposal Analysis (PSDDA) Program (Feb 2000) and U.S. EPA Toxicity Equivalency Factors (U.S. EPA 1989; Ahlborg et al. 1994)

Figure 1. VANALCO Sampling Locations

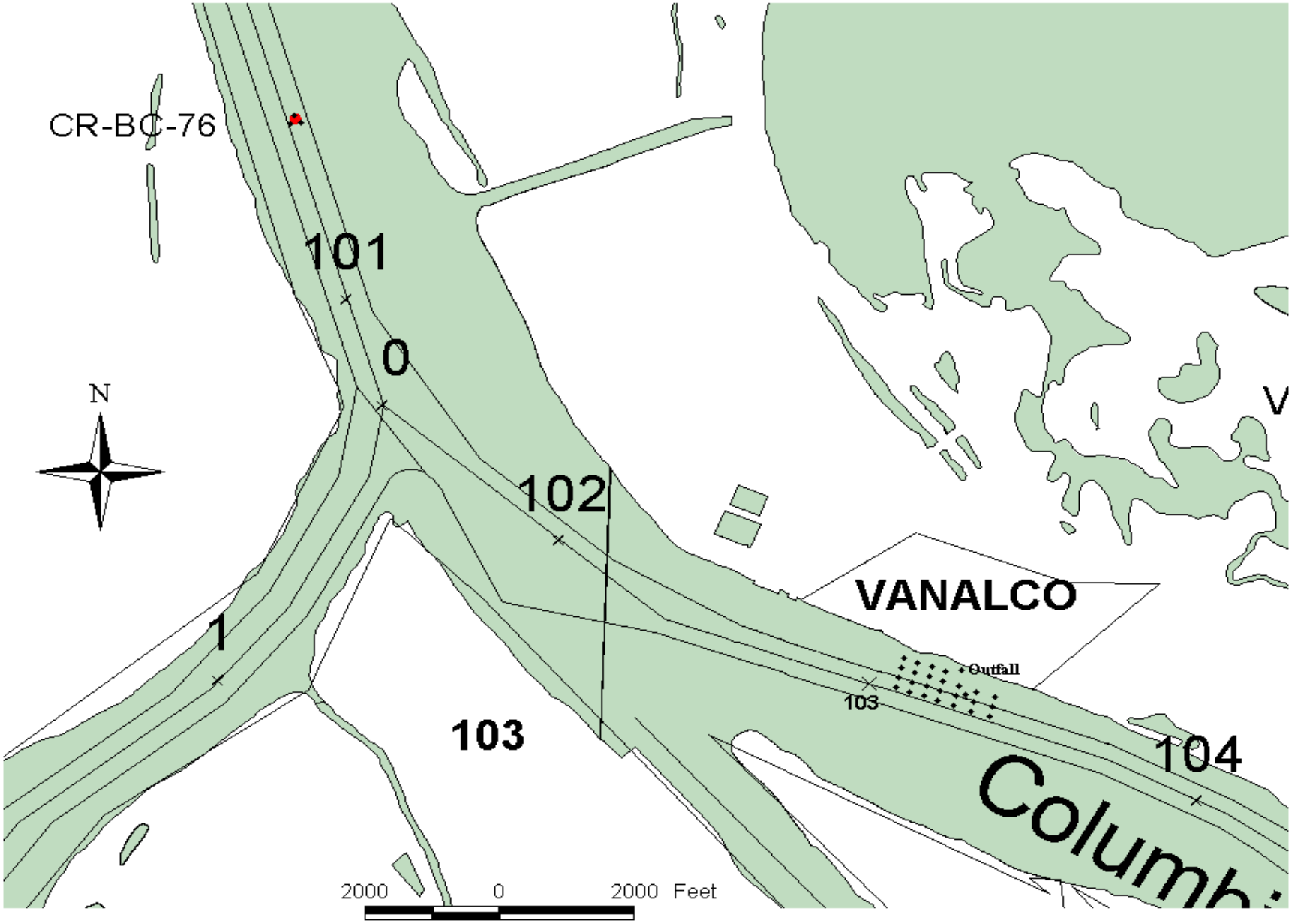

Figure 2. VANALCO Sampling Locations